CLAIMS

What is claimed is:

1. A radio access network supporting mobile terminal communications comprising:

a mesh of RF-coupled radio base stations, each said radio base station operative to transmit and receive communications traffic to and from one or more mobile terminals, and to relay communications traffic to and from other ones of said radio base stations in said mesh;

at least one concentrator coupled to at least one said radio base station in said mesh to carry the aggregate of communications traffic associated with said mesh; and

a base station controller communicatively coupled to said at least one concentrator to process communications traffic to and from said mesh.

2. The radio access network of claim 1 wherein said mesh of radio base stations comprises an IP-based packet data network wherein each radio base station routes packet data intended for other radio base stations within said mesh.

3. The radio access network of claim 2 wherein each said radio base station comprises:

a mobile terminal interface comprising first RF resources operative to communicate with a plurality of mobile terminals operating in a coverage area of said radio base station;

a backhaul interface comprising second RF resources operative to communicate with other ones of said radio base stations in said mesh;

a controller to control operation of said radio base station; and

a router to transmit and receive packet data through said backhaul interface, said packet data comprising communications traffic for any mobile terminals supported by said radio base station as well as communications traffic for other radio base stations in said mesh.

4. The radio access network of claim 3 wherein said backhaul interface in at least some of said radio base stations in said mesh further comprise RF resources operative to communicate with one or more of said concentrators coupling said mesh to said base station controller.

5. The radio access network of claim 3 wherein said router comprises an IP-based router, and wherein each said radio base station in said mesh functions as a router within said mesh.

6. The radio access network of claim 3 wherein said first RF resources comprise RF transceivers implementing a standardized cellular communications air interface suitable for signaling between the mobile terminals and said radio base station.

7. The radio access network of claim 3 wherein said second RF resources comprise RF transceivers implementing a second air interface.

8. The radio access network of claim 7 wherein said second air interface is an ISM-based air interface.

9. The radio access network of claim 1 wherein said concentrator is a mesh attachment point comprising:

a first communications interface to communicatively couple said mesh attachment point to said base station controller;

a second communications interface comprising RF transceiver resources to communicatively couple said mesh attachment point with said backhaul interfaces of one or more adjacent radio base stations in said mesh; and

a router to relay communications traffic between said mesh and said base station controller.

10. The radio access network of claim 1 wherein said concentrator is a mesh attachment point comprising a first communications interface coupled to said base station controller and a second communications interface coupled to one or more radio base stations in said mesh.

11. The radio access network of claim 10 wherein said second communications interface comprises RF transceiver resources for communicating with said one or more radio base stations in said mesh via RF signaling.

12. The radio access network of claim 1 wherein said base station controller comprises a control system operative to:

configure routing tables maintained in said radio base stations comprising said mesh to establish routing paths through said mesh; and

update said routing tables during operation of said radio access network to dynamically adjust said routing paths based on the respective volume of communications traffic being relayed by radio base stations within said mesh.

13. The radio access network of claim 12 wherein said base station controller comprises a control system further adapted to update said routing tables during operation of said radio access network to dynamically adjust said routing paths to avoid malfunctioning radio base stations within said mesh.

14. The radio access network of claim 1 wherein said radio base stations comprising said mesh are pico radio base stations.

15. The radio access network of claim 1 further comprising a network manager communicatively coupled to said base station controller and operative to provide network management functions for said mesh of radio base stations.

16. A method of providing wireless communication service coverage, the method comprising:

passing communications traffic for a mobile terminal from a base station controller to a mesh of RF-coupled radio base stations;

routing the communications traffic for said mobile terminal through one or more intervening radio base stations in said mesh as needed to reach a serving radio base station;

transmitting the communications traffic for said mobile terminal from said serving radio base station to said mobile terminal;

receiving communications traffic from said mobile terminal at said serving radio base station; and

routing the communications traffic from said mobile terminal from said serving radio base station through one or more intervening radio base stations in said mesh as needed to reach said base station controller.

17. The method of claim 16 further comprising:

configuring each radio base station in said mesh as an IP-addressable routing node; and

transporting the communications traffic to and from said mobile terminal through said routing nodes in said mesh as IP-based packet data.

18. The method of claim 17 further comprising determining a route through said mesh for packet data comprising the communications traffic associated with said mobile terminal based on the relative amount of additional communications traffic associated with other mobile terminals being routed by individual ones of said radio base stations in said mesh.

19. The method of claim 17 further comprising dynamically updating said route based on changing communications traffic load conditions at said radio base stations in said mesh.

20. The method of claim 17 further comprising dynamically updating said route based on detecting malfunctioning radio base stations within said mesh.

21. The method of claim 17 further comprising:

organizing said communications traffic as IP-based packet data; and

routing said communications traffic through said mesh based on IP addressing information contained in IP packet data headers.

22. The method of claim 16 further comprising:

maintaining routing tables in each said radio base station in said mesh; and

routing communications traffic through said mesh based on said routing tables.

23. The method of claim 16 further comprising communicatively coupling said mesh to said base station controller through a concentrator that carries the aggregate of communications traffic passing between said mesh and said base station controller.

24. The method of claim 23 wherein communicatively coupling said mesh to said base station controller through a concentrator comprises RF coupling said concentrator with at least one said radio base station in said mesh such that other said radio base stations can relay communications traffic through said at least one said radio base station communicatively coupled to said concentrator.

25. The method of claim 23 further comprising coupling said mesh to said base station controller through at least two said concentrators, such that the aggregate of communications traffic may be split between said at least two concentrators.

26. The method of claim 23 further comprising positioning said concentrator to maximize the number of radio base stations within said mesh with which said concentrator can communicatively couple.

27. The method of claim 16 further comprising:

determining the RF coupling between respective ones of said radio base stations comprising said mesh at a central network manager;

generating routing information at said central network manager based on said determined RF couplings; and

distributing said routing information to said radio base stations comprising said mesh.

28. The method of claim 27 wherein said mesh of radio base stations carries communications traffic associated with a plurality of mobile terminals and further comprising:

observing relative communications traffic loading between respective ones of said radio base stations comprising said mesh; and

updating said routing information in one or more of said radio base stations based on said relative communications traffic loading.

29. The method of claim 27 further comprising:

determining neighbor lists for individual ones of said radio base stations in said mesh identifying adjacent radio base stations in said mesh; and

providing said neighbor list information to said individual ones of said radio base stations.

30. The method of claim 27 wherein determining the RF-coupling between respective ones of said radio base stations comprising said mesh at a central network manager comprises evaluating RF signal strength for mesh interface signaling as reported between proximate ones of said radio base stations.

31. A radio base station for use in a meshed network of RF-coupled radio base stations, said radio base station comprising:

a wireless backhaul interface to support backhaul communications between radio base stations comprising said meshed network;

a wireless mobile terminal interface to support communication with one or more mobile terminals operating in a coverage area of said radio base station;

a router to send and receive communications traffic through said wireless backhaul interface;

said router adapted to relay communications traffic to other ones of said radio base stations in said meshed network when said radio base station is not the destination of communications traffic received through said wireless backhaul interface;

said router further adapted to pass communications traffic for local processing and transmission via said wireless mobile terminal interface when said radio base station is the destination of communications traffic received through said wireless backhaul interface.

32. The radio base station of claim 31 wherein the communications traffic comprises packet data and wherein said router in said radio base station comprises a packet data router.

33. The radio base station of claim 32 wherein said packet data is configured as IP packet data and said router in said radio base station comprises an IP router.

34. The radio base station of claim 33 wherein said meshed network comprises an IP network of RF-coupled radio base stations, and said radio base station comprises an IP routing node within said meshed network.

35. The radio base station of claim 31 wherein said wireless backhaul interface comprises first radio frequency transceiver resources adapted to communicatively couple said radio base station to one or more other radio base stations within said meshed network via RF links.

36. The radio base station of claim 35 wherein said first radio frequency transceiver resources comprise ISM-band transceiver resources.

37. The radio base station of claim 31 wherein said wireless mobile terminal interface comprises second radio frequency transceiver resources adapted to send and receive information between said radio base station and a plurality of mobile terminals, said radio frequency transceiver resources configured to operate in accordance with a desired air interface standard.

38. A method of processing communications traffic associated with a mobile terminal in a first radio base station forming part of a networked mesh of RF-coupled radio base stations, the method comprising:

receiving packet data from an external source at said first radio base station in said mesh;

processing said packet data locally in said first radio base station if said packet data is intended for said first radio base station; and

relaying said packet data to a second radio base station if said packet data is not intended for said first radio base station.

39. The method of claim 38 wherein said processing said packet data locally in said first radio base station comprises transmitting said packet data to a mobile terminal.

40. The method of claim 38 wherein receiving packet data from an external source comprises receiving packet data from a third radio base station in said mesh.

41. The method of claim 38 wherein receiving packet data from an external source comprises receiving packet data from a mesh attachment point, said mesh attachment point operative to communicatively couple said first radio base station to a base station controller.

42. The method of claim 38 wherein receiving packet data from an external source comprises receiving packet data from a mobile terminal.

43. The method of claim 38 further comprising relaying said packet data to a mesh attachment point linking said mesh to a base station controller if said packet data is

intended for said base station controller and said first radio base station is in communications with said mesh attachment point.

44. The method of claim 38 further comprising determining whether the packet data is intended for said first radio base station by determining whether a destination address of said packet data corresponds to a network address associated with said first radio base station.

45. The method of claim 38 wherein the packet data comprises IP packet data and further comprising operating each said radio base station comprising said mesh as an IP router for relaying IP packet data as needed to reach desired ones of said radio base stations in said mesh.

46. The method of claim 38 further comprising:

receiving routing table information from a network manager associated with said mesh, said routing table information bearing on the available route paths within said mesh; and

routing packet data as needed from said first radio base station to other ones of said radio base stations in said mesh based at least in part on said routing table information.

47. A method of providing wireless communication service to a mobile terminal, the method comprising:

receiving communication traffic for the mobile terminal at a first radio base station comprising one of a plurality of radio base stations that together comprise a networked mesh of radio base stations;

transmitting the communications traffic from said first radio base station to a mobile terminal served by said first radio base station if the communications traffic is destined for said mobile terminal; and

routing the communications traffic to a second said radio base station in said meshed network if the communications traffic is not destined for said first radio base station.

48. The method of claim 47 further comprising:

forming said networked mesh of radio base stations by arranging said plurality of radio base stations throughout a given physical area; and

coupling adjacent ones of said radio base stations in said networked mesh via RF signaling links to form network connections between said adjacent ones.

49. The method of claim 47 further comprising

determining available network paths formed by intercoupled ones of said plurality of radio base stations comprising said networked mesh;

providing routing information bearing on the available network paths to said plurality of radio base stations comprising said networked mesh; and

routing communications traffic not destined for said first radio base station to other ones of said radio base stations in said networked mesh based on said routing information.

50. A method of providing wireless communication service to a mobile terminal, the method comprising routing communications traffic between a mobile terminal and a base station controller through a mesh of interconnected radio base stations, wherein a final radio base station in said mesh serving said mobile terminal receives communications traffic for said mobile terminal through at least one other radio base station in said mesh, and wherein said final radio base station routes communications traffic from said mobile terminal to said base station controller through at least one other radio base station in said mesh.

51. The method of claim 50 further comprising determining a best route through said mesh for communication traffic to and from said final radio base station based on a desired quality of service associated with said communication traffic.

52. The method of claim 50 further comprising maintaining one or more routing tables for said mesh, said routing tables at least describing a best routing path for communication traffic associated with said final radio base station.

53. The method of claim 52 wherein a plurality of radio base stations in said mesh are each serving at least one mobile terminal, and further comprising maintaining said one or more routing tables to identify a best path through said mesh for communication traffic to and from any one of said plurality of radio base stations.